# Perlite

## TECHNICAL DATA SHEET / No. 2-4 1983

## PERLITE LOOSE FILL INSULATION

BUILDING, HIGH TEMPERATURE, LOW TEMPERATURE AND CRYOGENIC APPLICATIONS

Perlite is a naturally occurring siliceous volcanic rock containing two to six per cent combined water. When the crude rock is crushed and heated above 1600 °F (871 °C), the combined water vaporizes and the perlite expands four to twenty times its original volume. This expansion process creates countless cells in the glassy particles which account for the excellent thermal conductivity of expanded perlite.

Perlite loose fill insulation provides dependable results at temperatures ranging from -452 °F to +2000 °F (-269 °C to +1093 °C).

### BUILDING INSULATION

Expanded perlite for loose fill construction applications should conform to ASTM Specification C549 "Perlite Loose Fill Insulation" and be treated with a non-flammable silicone to improve water repellency. Silicone treated perlite provides a quick, inexpensive method for permanently insulating masonry walls.

Figure 1 indicates the relationship between thermal conductivity and density at various mean temperatures. The recommended density for building applications of loose fill insulation is 2 to 11 lb/ft³ (32 to 176 kg/m³), and Figure 2 plots thermal conductivity as related to increasing mean temperature for expanded perlite at 3, 8 and 11 lb/ft³ (48, 128 and 176 kg/m³).

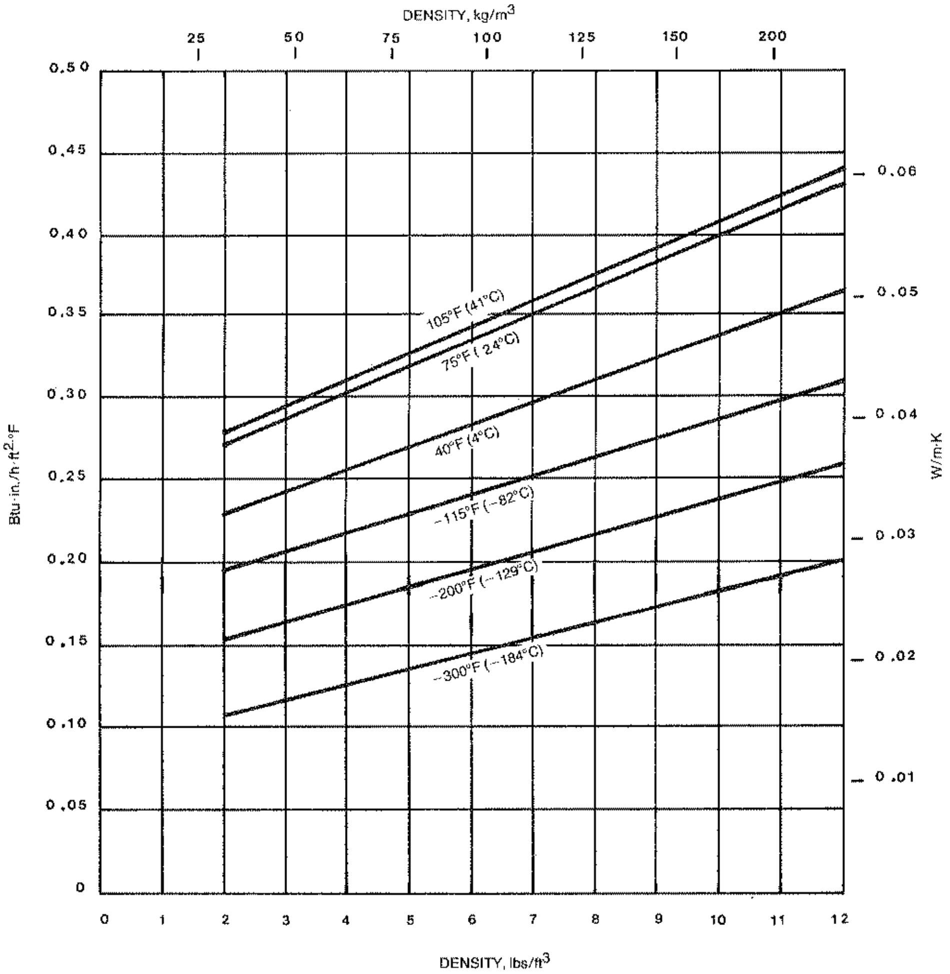

**Figure 1**

### LOW TEMPERATURE AND CRYOGENIC INSULATION

Expanded perlite is an inexpensive insulation for low temperature and cryogenic applications. It is widely used because of its low thermal conductivity, cost, ease of handling, non-flammability and low moisture retention.

Liquified gases having boiling points as low as -452 °F (-269 °C) have created a demand for storage facilities capable of economically reducing evaporation losses. While the storage vessels vary as to configuration, type of supports and ac-

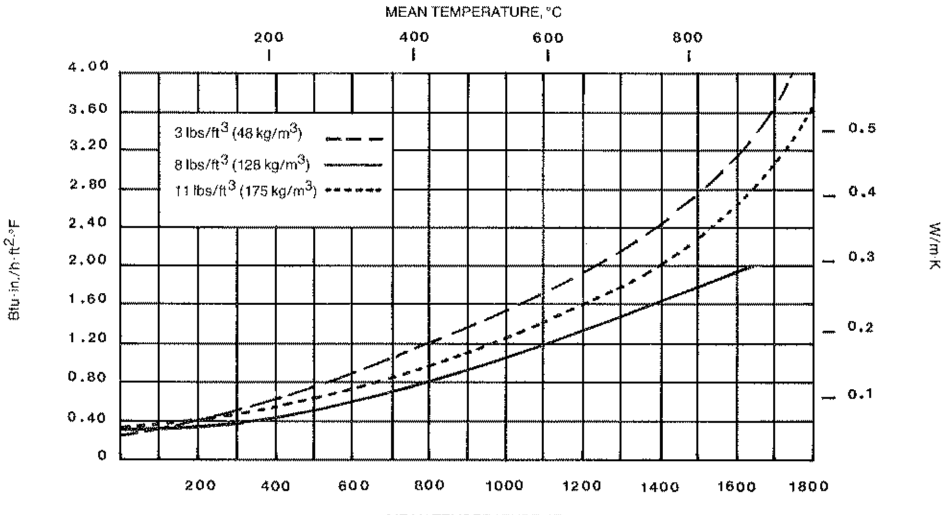

**Figure 2**

cessory equipment, a large majority of the vessels are of double wall construction, and the annulus is filled with expanded perlite. Although other powder insulations have occasionally been used, their greater cost has not warranted their use in most applications.

Figure 1 indicates probable values of the apparent thermal conductivity of expanded perlite of from 2 to 12 lbs/ft³ (32 to 192 kg/m³) at a pressure of one atmosphere and mean temperatures from -300°F to +105°F (-184°C to 41°C).

## HIGH TEMPERATURE INSULATION

Expanded perlite is used as insulating cover on the surface of molten metal to prevent excessive heat loss during delays in pouring; to top off ingots to reduce piping and decrease lamination; to produce refractory blocks and bricks; and in several important foundry applications. The data in Figures 2 and 3 cover a range of perlite densities at mean temperatures as high as 1800°F (982°C). Although thermal conductivity increases appreciably above 1800°F (982°C), expanded perlite has been used at service temperatures as high as 2000°F (1093°).

## Atmospheric Service

The thermal conductivity of expanded perlite insulation at atmospheric pressure conditions has been shown to correlate directly with density, while perlite gradation has only a minor effect on thermal conductivity.

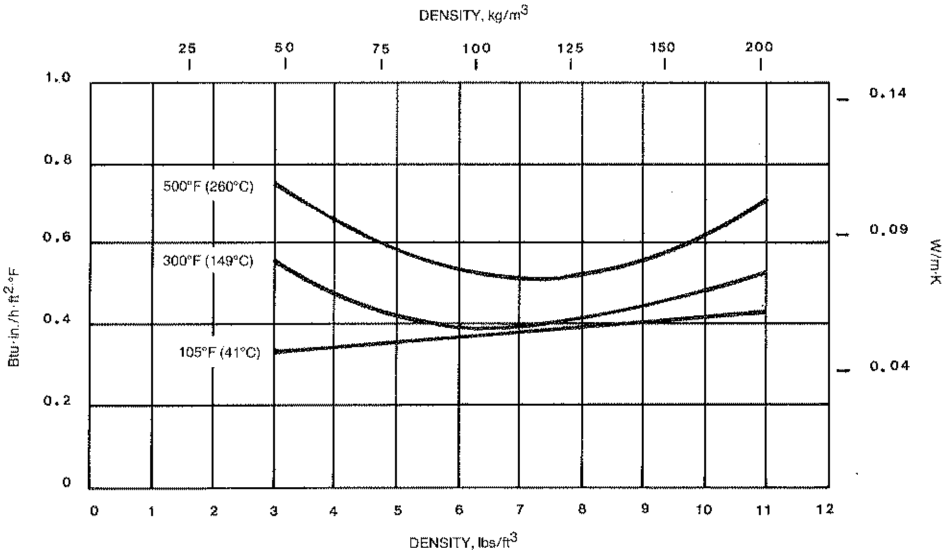

**Figure 3**

## Evacuated Service

Expanded perlite is non-hygroscopic, which adapts it for use under vacuum conditions. If evacuation is to be accomplished in a minimum amount of time, the perlite must be kept dry and the interstitial gas should have a low heat of adsorption. Heat transfer through an evacuated perlite filled annulus is a combination of solid conduction and thermal radiation. Gas conduction is also an important transfer mechanism if the interstitial gas pressure is not reduced to a suitable level.

REFERENCES

1. J.L.F. Research, Inc., Reports dated December 24, 1962, January 2, 1964, July 1, 1965.
2. "Thermal Conductivity of Expanded Perlite Cryogenic Fill Insulation," G.R. Kinzer, Jr., ASHRAE Journal, February, 1963.
3. "Thermal Conductivity of Perlite at Low Temperatures," L. Adams, Cryogenic Technology, March-April, 1965.

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